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ABSTRACT

This course entitled "Desert Biology" is one of a series of instructional guides prepared by teachers for the Sahuarita High School (Arizona) Career Curriculum Project. It consists of seven units of study, and eight behavioral objectives relating to these units are stated. The topics covered include the selection of a study site, a climatic analysis, identification of plants and animals, plant sampling by the line intercept method, animal census methods, soil texture analysis, and the preparation of a scientific paper. The units provide a statement of the rationale, objectives, sources of information, a series of student activities, and a post-evaluation. For related units in this series see SE 016 635 - SE 016 644. (JR)

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ED 080373

SAHUARITA HIGH SCHOOL

CAREER

CURRICULUM

PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT I

BY

LARRY CHRISTENSEN

SE 016 639

OBJECTIVES

DESERT BIOLOGY

1. You will be able to use the instruments necessary to obtain reading for temperature, relative humidity, and precipitation.

2. You will be able to maintain a daily log of climate conditions on your study site.

3. Using the available field guides, teaching collection and the area surrounding the school you will identify a minimum of 20 plants, 10 birds, 10 mammals, and 10 amphibians and reptiles from the lists provided.

4. You will be able to calculate percent of coverage, indicate the dominant vegetative type, and give an indication of the diversity of your study plot using the Line Intercept Method of plant sampling.

5. You will be able to conduct a small rodent census using the capture-mark-recapture method.

6. You will be able to list the birds observed on your study site.

7. You will use two methods to obtain an analysis of the texture of the soil in your study plot.

8. Comparisons will be made between the two methods and in various different vegetative associations.

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Desert Biology
Introduction

To the student:

You have completed at least one semester of Biology and should now have a basic understanding of the living world. This course will attempt to introduce you to interactions between that biotic world and the non-living world around it. You will select a study site of approximately 5625 square meters (75m x 75m). On this site you will determine which are the dominant vegetation types, you will conduct an animal census, you will sample the soil texture and chemical composition, you will also record such climatic factors as, 1) amount of rainfall, 2) maximum and minimum temperatures and, 3) relitive humidity at various times including night. The final result will be a paper explaining your study and any conclusions you can make.

DESERT BIOLOGY

UNIT 1

SELECTION OF THE STUDY SITE

This is perhaps the most important unit of this course. If you make a poor site selection your study may be very difficult and your work in vain.

You will pick an area just north of the school in an area that will recieve very little traffic. Try and pick an area with as much diversity as possible. Avoid any site where the vegetation density is too great so as to prevent reasonable study of the animal life present.

The physical size of your area should be about 75 meters square, you will mark your corners with a wooden stake. Avoid overlapping someone elses plot if possible. When you believe you have your study plot marked out have your instructor check your site. Be prepared to explain why you have chosen you site.

Lastly but perhaps most important do nothing to change the site in any way. Do not remove any vegetationand any animals that you might trap must be returned to the area where it was captured. Simply leave it like you found it. Take out anything you take in,don't use your site as a garbage dump.

ACTIVITES

1. You will select an appropriate study site of approximately 75 meters x 75 meters.
2. Mark the four corners with wooden stakes labeled with your name and which corner it is.
3. Have your instructor check your site and obtain his signature on your check sheet.

POST-EVALUATION

1. Instructors approval of study site.

   A. Size _____

   B. Marking of corners _____

   C. Vegetation density _____

SAHUARITA HIGH SCHOOL

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PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT II

BY

LARRY CHRISTENSEN

DESERT BIOLOGY

UNIT II

CLIMATE ANALYSIS

To understand the desert you must understand first why any given area is a desert. To do this you must have a good understanding of the factors affecting the environment of an area and the methods used to quantify them.

Objectives:

1. You will be able to use the instruments necessary to obtain reading for temperature, relitive humidity, and precipitation.
2. You will be able to maintain a daily log of climate conditions on your study site.

Activities:

1. You will maintain a daily log of climatic condtions at your study sitse using the provided forms. The data from your log will be graphed and included in your final report.

Information Sources:

1. A Golden Guide to Weather esp. p. 118-131
2. The Desert - Life Nature Series. (Library)
3. Instructor lectures

Post Evaluation:

1. You will be graded on the completeness of your raw data and graph in your final report.

DESERT BIOLOGY

UNIT II

DAILY LOG OF CLIMATIC CONDITIONS

Name_____

Date_____

Time_____

Temperature_____

Relitive humidity_____

Last 24 hrs.

Amount of precipitation_____

Max. temperature_____

Min. temperature_____

Unusual conditions_____

_____

DAILY LOG OF CLIMATIC CONDITIONS

Name_____

Date_____

Time_____

Temperature_____

Relitive humidity_____

Last 24 hrs.

Amount of precipitation_____

Max. temperature_____

Min. temperature_____

Unusual conditions_____

_____

DAILY LOG OF CLIMATIC CONDITIONS

Name_____

Date_____

Time_____

Temperature_____

Relative humidity_____

Last 24 hrs.

Amount of precipitation_____

Max. temperature_____

Min. temperature_____

Unusual conditions_____

_____

DAILY LOG OF CLIMATIC CONDITIONS

Name_____

Date_____

Time_____

Temperature_____

Relative humidity_____

Last 24 hrs.

Amount of precipitation_____

Max. temperature_____

Min. temperature_____

Unusual conditions_____

_____

SAHUARITA HIGH SCHOOL

CAREER

CURRICULUM

PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT III

BY

LARRY CHRISTENSEN

Desert Biology

Unit III

Identification

To be able to study the ecology of our desert you must be able to identify the various plants and animals.

Objectives

1. Using the available field guides, teaching collection and the area surrounding the school you will identify a minimum of 20 plants, 10 birds, 10 mammals & 10 amphibians and reptiles from the lists provided.

Activities

1. Using the available field guides, teaching collection and the area surrounding the school you will identify a minimum of 20 plants, 10 birds, 10 mammals & 10 amphibians and reptiles from the lists provided.

Information Sources

1. Teaching collection of birds, mammals, and amphibians and reptiles.
2. Plant press notebooks and laminated collection
3. Field Guide to Western Birds
4. Field Guide to the mammals
5. Field Guide to the amphibians and Reptiles
6. Field Guide to the Insects
7. Vertebrates of Arizona-(good reference for Scientific names).

Post Evaluation

1. Using the available field guides, teaching collection and the area surrounding the school you will identify a minimum of 20 plants, 10 birds, 10 mammals & 10 amphibians and reptiles from the lists provided.

Desert Biology

Unit III

Common desert plants-

1. Catclaw
2. White thorn
3. Blue Palo Verde
4. Foothill Palo Verde
5. Mesquite
6. Desert Broom
7. Desert Hackberry
8. Creosote bush
9. Small leaf Krameria
10. Mexican tea
11. Sahuaro Cactus
12. Prickly Pear
13. Barrel Cactus
14. Chain fruit Cholla
15. Staghorn Cholla
16. Mammaleria
17. Century Plant
18. Sotol
19. Yucca
20. Ocotillo

Desert Biology

Unit III

Common desert birds

1. Turkey Vulture
2. Red-tailed Hawk
3. Sparrow Hawk
4. Gambel's Quail
5. Roadrunner
6. White-winged Dove
7. Mourning Dove
8. Gilder Flicker
9. Gila Woodpecker
10. Ash-throated Flapcatcher
11. Verdin
12. Cactus Wren
13. Mocking bird
14. Curve-billed Thrasher
15. Phaino pepla
16. Loggerhead Shrike
17. Starling
18. House Finch
19. Brown Towhee
20. Black-throated Sparrow

Desert Biology

Unit III

Common desert mammals

1. Javelina
2. White tail deer
3. Male deer
4. Mountain lion
5. Bobcat
6. Coyote
7. Raccoon
8. Coati
9. Striped Skunk
10. Cottontail
11. Blacktail Jackrabbit
12. Antelope Jackrabbit
13. White throat Woodrat
14. Valley pocket Gopher
15. Merriams kangaroo rat
16. Cactus Mouse
17. Pocket Mouse
18. Grasshopper Mouse
19. Antelope ground squirrel
20. Round Tail ground squirrel
21. Mexican Freetail Bat
22. California leaf nose bat
23. Western Pipistrelle bat
24. Big Brown Bat
25. Rock Squirrel

Desert Biology

Unit III

Common desert amphibians & reptiles

1. Western Spadefoot toad
2. Colorado River toad
3. Canyon Tree frog
4. Leopard Frog
5. Desert tortise
6. Gila monster
7. Desert Iguana
8. Collared Lizard
9. Chuckwalla
10. Greater Earless Lizard
11. Mountain Spiny Lizard
12. Sonora Spiny Lizard
13. Desert Spiny Lizard
14. Tree Lizard
15. Side blotched Lizard
16. Regal Horned Lizard
17. Western Whiptail
18. Checkered Garter Snake
19. Coachwhip
20. Bullsnake
21. Common Kingsnake
22. Arizona Coral Snake
23. W. diamondback Rattlesnake
24. Mohave Rattlesnake
25. Sidewinder

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PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT IV

BY

LARRY CHRISTENSEN

Desert Biology
Unit IV
Plant Sampling by the Line Intercept Method.

There are many methods of determing the number and diversity of the plant life in a given area. A method used in a hard wood forest might not work in the desert. One factor that is of interest in the desert is that of percent of coverage. That is, the percentage of the ground that is covered by vegetation. The Line Intercept Method will give acceptable percent coverage data and an indication of diversity and dominance.

Objectives

1. You will be able to calculate percent of coverage, indicate the dominant vegetative type, and give an indication of the diversity of your study plot using the Line Intercept Method of plant sampling.

Activities

1. Using the Line Intercept Method of plant sampling you will obtain 1) the percent of coverage, 2) an indication of the dominant vegetative type and, 3) an indication of the diversity of your study site.

Information Sources

1. Attatched study guide

Post-Evaluation

1. All above information will be included in your final report.

Desert Biology
Unit IV
THE LINE-INTERCEPT METHOD

The line-intercept method of measuring vegetation consists the horizontal, linear measurement of plants along a line. Readings are make in units of length along the line and the total length of these intercepts is accepted as a numerical value representing the ground surface (area) occupied by the plants.

The theory underlying this method is that enough lines will be sampled within a floristically homogeneous areas to provide a representative sample of the whole. The number of lines and their length will therefore depend on how nearly true homogeneity is achieved, on the fraction of the area that is covered by vegetation and on the size of the area being sampled. The greater the degree of homogeneity (i.e. the more uniform the composition), the greater the percentage of the area covered by vegetation, and the smaller the area, the shorter the total transect (sum of all the lines) need be.

Method: Quoting from Methods of Surveying and Measuring Vegetation by Dorothy Brown: "The sampling units are randomly located lines of equal length along which are measured the intercepts of plants. To mark the line, a multiple strand of wire, 0.0625 in. or less in diameter and having a 1-in. ring attached at each end, is stretched on the ground under as much tension as can be exerted with the hands. The wire is held in place under tension

by inserting iron pins through the rings and driving the pins into the ground. Using a collapsible steel measuring tape, measurements are made of plants on the course of the line... Plant measurements are read to the nearest hundredth foot or quarter centimeter according to the measurement system adopted. Grasses and forbs are measured at ground level; if the forbs are single-stemmed they are measured on the stem diameter, but if rosette form then on the intercept of the basal leaves. In this way an estimate of ground surface actually occupied by these types of plants is arrived at by actual measurements. Browse plants (bushes) are measured on the crown spread. The total intercepts for species, separated into grasses, forbs and brows plants are recorded on an appropriate form."

In this course we shall follow the general procedure set forth above but with specific application as follows:

1. The line transects will be located on the same side of and at right angles to a predetermined base line that will be located due E-W or due N-S.

2. The line transects will be uniformly spaced at 5-meter (16,4 ft.) intervals along the base line and each will be 25 meters (82.0 ft.) long. As the transects are all at right angles to the base line they will parallel each other.

3. Each measurement area will be sampled by 5 of these line transects.

4. Because of procurment problems, in place of a collapsible steel measuring tape, we shall use 1-meter or 2-meter measuring sticks for determining plant spread along the transect. Measurements will be recorded in centimeters.

5. In using the recording form that is provided, each species encountered should be listed at the top of the form on the line labeled "species". These should be entered by symbols as follows:

a. If a plant has a compound name as, for example, Foothill Paloverde, use the first 2 letters of each name, i.e. Fopa or, as in Desert Zinnia, Dezi. If a plant can properly be identified by one name as for example, Saguaro, use the first 3 letters, i.e. Sag or, for Creosotebush, Cre. On the back of the form list all species encountered with the appropriate symbol for each.

b. Combine all the individual line transects for a given measurement area on one (or if necessary, more than one) sheet. Thus all the measurements for a given species for all 5 transects in a given area are listed consecutively in a column, but without separating the measurements on a basis of transects. Each group of 5 transects constitutes a unit; the individual transects do not.

6. Where large gaps with no ground cover occur wihtin the exterior boundaries of any plant, these open areas should be included.

7. The 5 transects in each measurement area have a combined length of 125 m. or 12,500 cm. As the vegetation, by species, will be measured in cm., the coverage of each species should be recorded as a fraction of 12,500, then multiplied by 100 for conversion as a percentage of the whole. For ezample: assume that creosotebush measures a line intercept on all 5 lines of 900cm. This figure, divided by 12,500 equals .072. Thus .072 x 100 = 7.2 percent of the area, as indicated by actual measurement, is covered by creosotebush.

8. The measurements for each plant species are separately totaled, expressed as a percentage of the whole and these percentages finally summed to give the total plant coverage of the area.

9. For conversion to density for each species, simply divide the total number of measured individuals for that species by the total area sampled. The latter is estimated to be 750 m^2 (25 x 30 m.). For example, if there are 27 individuals of creosotebush measured in the transect area (traversed by the 5 25-meter line transects 5 meters apart), then 27 is divided by 750 to give .036 individual of creosotebush per 1 m^2 or 3.6 per 100 m^2 (.01 ha) or 360 per 10,000 m^2 (1 ha) or 145.7 per acre.

Desert Biology
Unit IV

LINE INTERCEPT DATA SHEET

Class Name team 1 - Sec 10

Veg. Type Mesquite - Creosote bush Lines: (No.) 5 (Length) 25m

Location Ajo & Mission Rd. Transect # 1 Date: 25 Oct 10

VEGETATION IN CENTIMETERS BY SPECIES

Species	Fopa	Ccbu	Dezi	Mesq									
Totals	~~900~~ 925	1250	125	6250									
%	7.2	10.0	1.0	50.0	= 68.2% plant coverage								
# of ind.	27	25	15	75									
ind/acre	145.7	133.2	80.0	400.0									

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PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT V

BY

LARRY CHRISTENSEN

Desert Biology
Unit V
Animal Census Methods

Animal census techniques usually fall into the category of counting as many animals as possible. This is an extremely difficult problem in the desert since a large number of the are diurnal (out only at night). The method varies depending on what animal you are attempting to census. Small rodents are often captured in a live trap, marked and then released. Other animals especially birds are often just counted on a daily basis. This type of data can be misleading especially in an area as small as yours. The home range of most animals is larger than your study plot.

Objectives:

1. You will be able to conduct a small rodent census using the capture-mark-recapture method.
2. You will be able to list the birds observed on your study site.

Activities:

1. Obtain or construct a live trap suitable for the capture of small rodents and conduct a census of your study area for at least 10 nights. List the types of animals taken, number of recaptures, bait used, and general area of your study site the animal was taken in.
2. Prepare a map of your study site showing the locations of any

nests, burrows, etc. that you can find.

3. Prepare a list of all other animal life observed on or near (within 10 meters) your study site.

Information Sources:

1. Quantitative Zoology p. 112-113.

2. Basic Concepts of Ecology p. 203-209.

Post Evaluation

1. Activities 1,2 & 3 are to be included in your final report.

SAHUARITA HIGH SCHOOL

CAREER

CURRICULUM

PROJECT

COURSE TITLE: DESERT BIOLOGY

UNIT VI

BY

LARRY CHRISTENSEN

Unit VI

Introduction

Soil texture is one of the more important abrotic factors that determines what vegetation types will inhabit an area. The hydrometer method is one way to obtain this data. Another is a qualitative field determination. We will learn both techniques and you can compare your results.

Objectives

1. You will use two methods to obtain an analysis of the texture of the soil in your study plot.

2. Comparisons will be made between the two methods and in various different vegetative associations.

Activities

1. You will obtain samples of approximately 50 grams from four locations; including 1) your study area, 2) a Larrea association (area near Sahuarita land fill), 3) a wash area, and 4) a cultivated area.

2. Using the attached study guides obtain a soil texture type using both methods on each sample.

3. Include your data in your final report.

Information Sources

1. Attached study guides

2. 1964 Book ASTM Standards. Part II.

Soil Texture

Soil texture may be defined as the relative proportions of the various soil separates of sand, silt, and clay. Rarely if ever, do soil samples consist wholly of one separate. The basic classes in order of increasing proportions of the fine separates are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay (see figure 1).

Note the percentage of sand, silt, and clay needed to place a soil in the various textural classes.

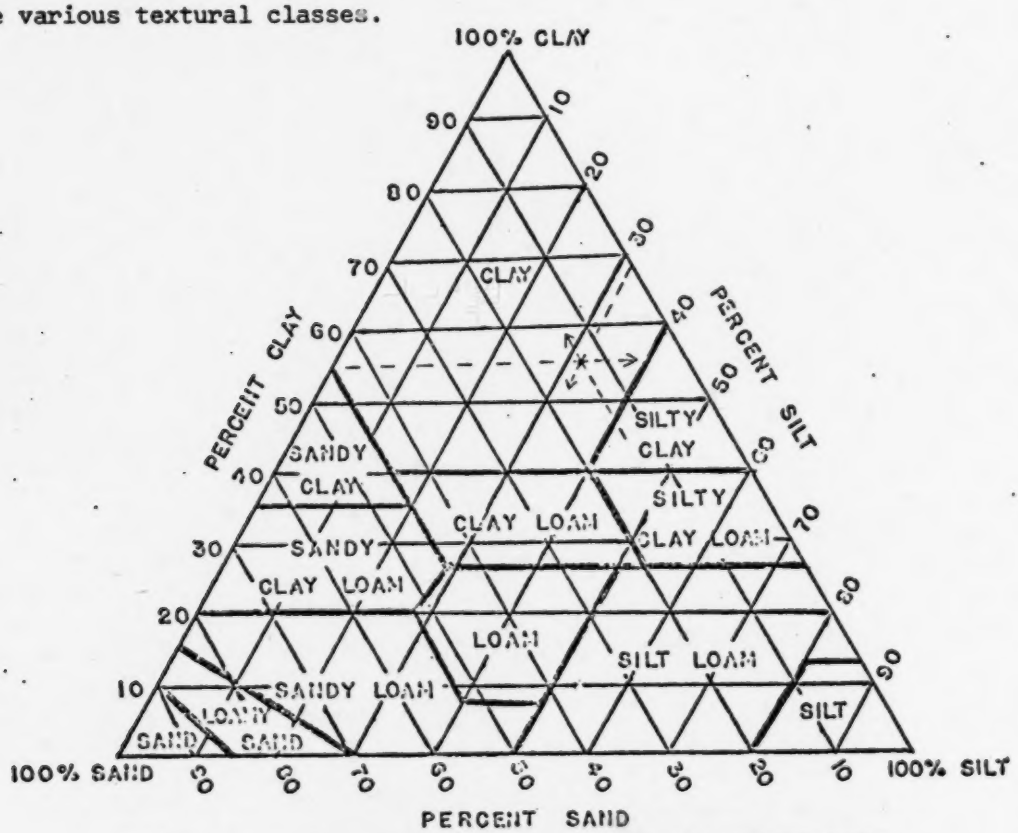

Figure 1. Texture triangle showing the percentages of sand, silt and clay in the textural classes. The intersection of the dotted lines shows that a soil with 55 percent clay, 32 percent silt and 13 percent sand has a clay texture.

Qualitative Field Determination

The determination of soil class is still made in the field mainly by the feel of the moist soil mass when rubbed or kneaded between the fingers, and sometimes supplemented by examination under the hand lens. The following general descriptions give the obvious physical characteristics of the textural class. All textural classes are not listed (see figure 2).

Sand. Sand is loose and single-grained. The individual grains can readily be seen or felt. Squeezed in the hand when dry they will fall apart when the pressure is released. When squeezed when moist, a cast will form, but it will crumble when touched.

Sandy Loam. A sandy loam contains much sand but which has enough silt and clay to make it somewhat coherent. The individual sand grains can readily seen and felt. Squeezed when dry, it will form a cast which will readily fall apart, but if squeezed when moist a cast can be formed that will bear careful handling without breaking.

Loam. A loam feels like it is a relatively even mixture of sand, silt, and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

Silt Loam. A silt loam is a soil having a small amount of fine sand and only a moderate amount of clay, over half the particles being silt. When dry it may appear quite cloddy, but the clods can be readily broken,

and when pulverized it feels soft and floury. When wet the soil readily runs together. Either dry or wet casts will form that can be freely handled without breaking, but when moistened and squeezed between thumb and finger it will not ribbon but will give a broken appearance.

Clay Loam. A clay loam is a fine textured soil that may form hard clods when dry. When the moist soil is pinched between the thumb and finger it will form a thin ribbon which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling and when kneaded in the hand it does not crumble readily but tends to work into a heavy compact mass.

Clay. A clay is a fine textured soil that usually forms very hard clods when dry and is quite plastic and usually sticky when wet. When the moist soil is pinched out between the thumb and fingers it will form a long, flexible ribbon. Some clays are friable and lack plasticity in all conditions of moisture.

Unit VI

Loam. A loam feels like it is a relatively even mixture of sand, silt, and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

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Clay Loam. A clay loam is a fine textured soil that may form hard clods when dry. When the moist soil is pinched between the thumb and finger it will form a thin "ribbon" which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling and when kneaded in the hand it does not crumble readily but tends to work into a heavy compact mass.

Clay. A clay is a fine textured soil that usually forms very hard clods when dry and is quite plastic and usually sticky when wet. When the moist soil is pinched out between the thumb and fingers it will form a long, flexible ribbon. Some clays are friable and lack plasticity in all conditions of moisture.

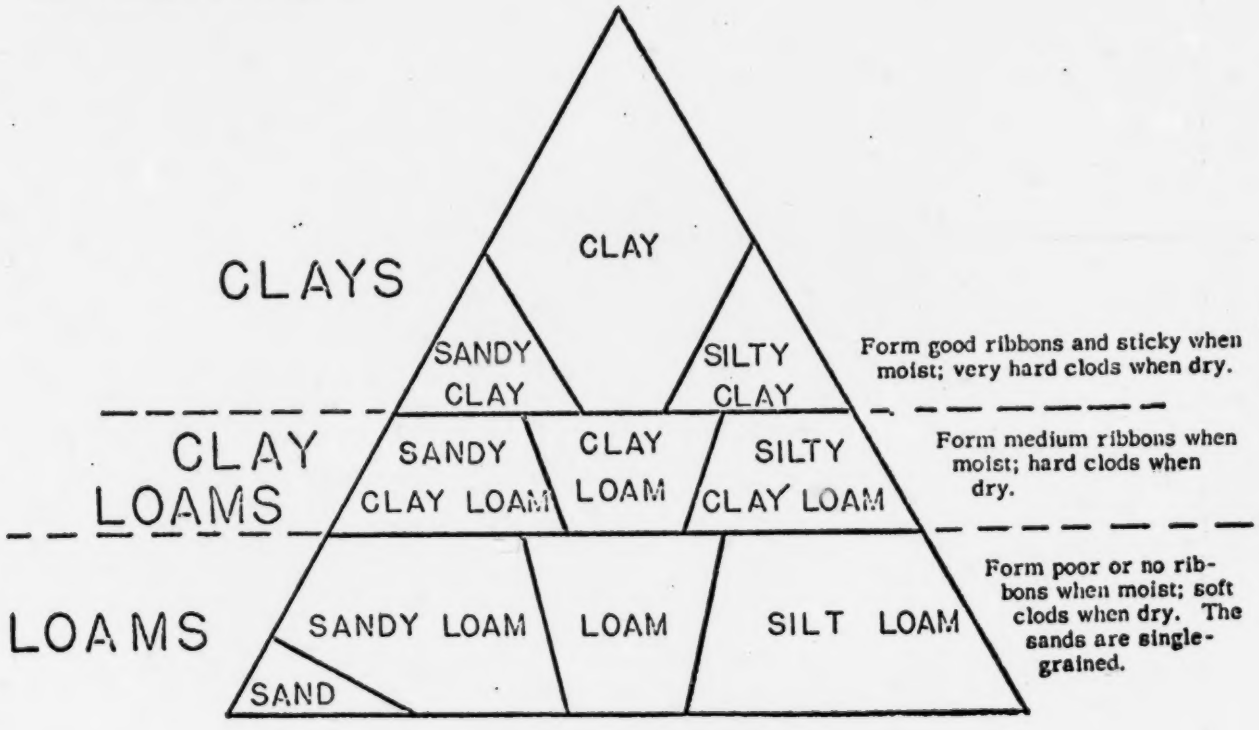

Figure 2. Modified textural triangle for determining soil texture by the feel method.

The following material has been deleted: "Soil Texture Analysis" from Laboratory Manual of General Ecology by George W. Cox.

Unit VI- The Scientific Paper

Rationale

"Knowledge without communication is ignorance." This is the terminal and perhaps the most importnat unit in this quarter. If the knowledge you have acquired in the past nine weeks is locked away in your head somewhere then it is useless to anyone but yourself. This is not the objective of the scientific community of which you are a part. Information on experiments, no matter how insignificant it may seem to you, taken together is the basis for our present level of technology.

Objectives

1. You will be able to write a scientific paper, of publishable quality, communicating the results of your study using as a model one of the attached papers from a biological journal.

Information Sources

1. Attached reprints.
2. A.I.B.S. Style Manual.
3. Instructor lectures.

Activities

1. You will write a scientific paper of publishable quality communicating the results of your study. You can use any of the attached reprints or the A.I.B.S. Style Manual for your model.

Post-Evaluation

1. Hand in your report for grading.

☐ Complete Instructor's Initials_____